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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LIII
No. 1367

SATURDAY, SEPTEMBER 8, 1945
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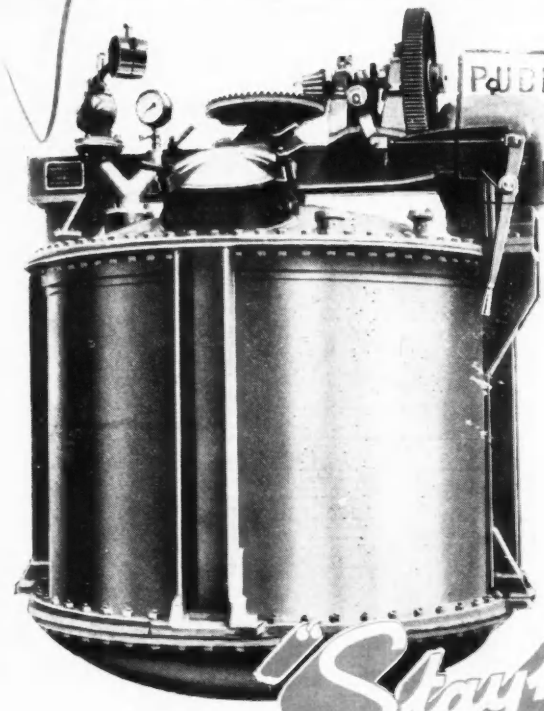

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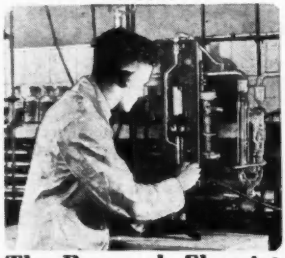

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The interest aroused in the public mind by the achievements of the Research Chemist is based primarily on the practical value of his discoveries, but the lay mind has little understanding of the difficulties and the problems encountered before laboratory synthesis can be translated into factory production. After the dramatic discovery comes the generally far more difficult task of meeting the demand occasioned by it, and such problems have been accentuated during the last few years by the worry of wartime scarcities. Patience, resource and unremitting effort are just as necessary in research and development work as the occasional flash of inspiration, and these qualities have helped the chemist to deal successfully with the many troublesome situations which the war has brought.

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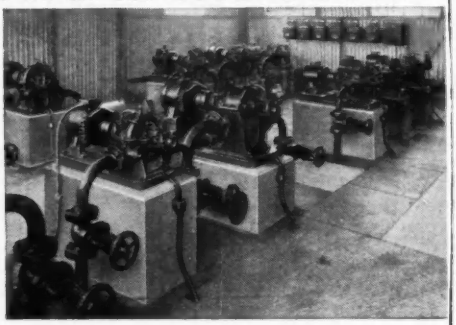

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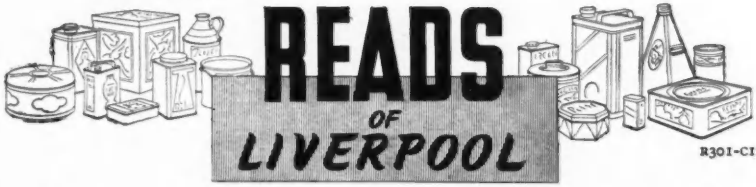

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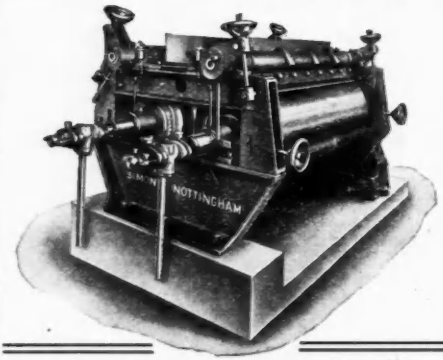

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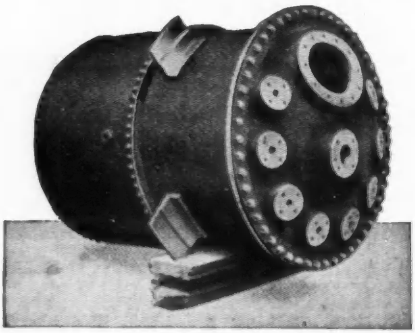

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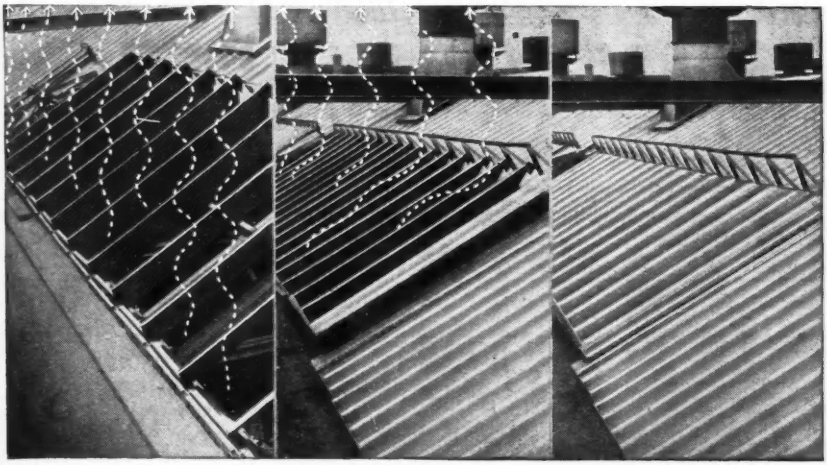

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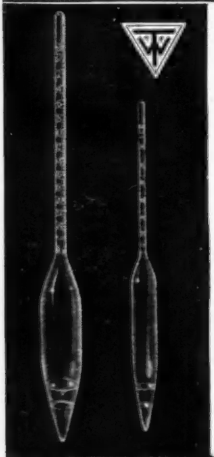

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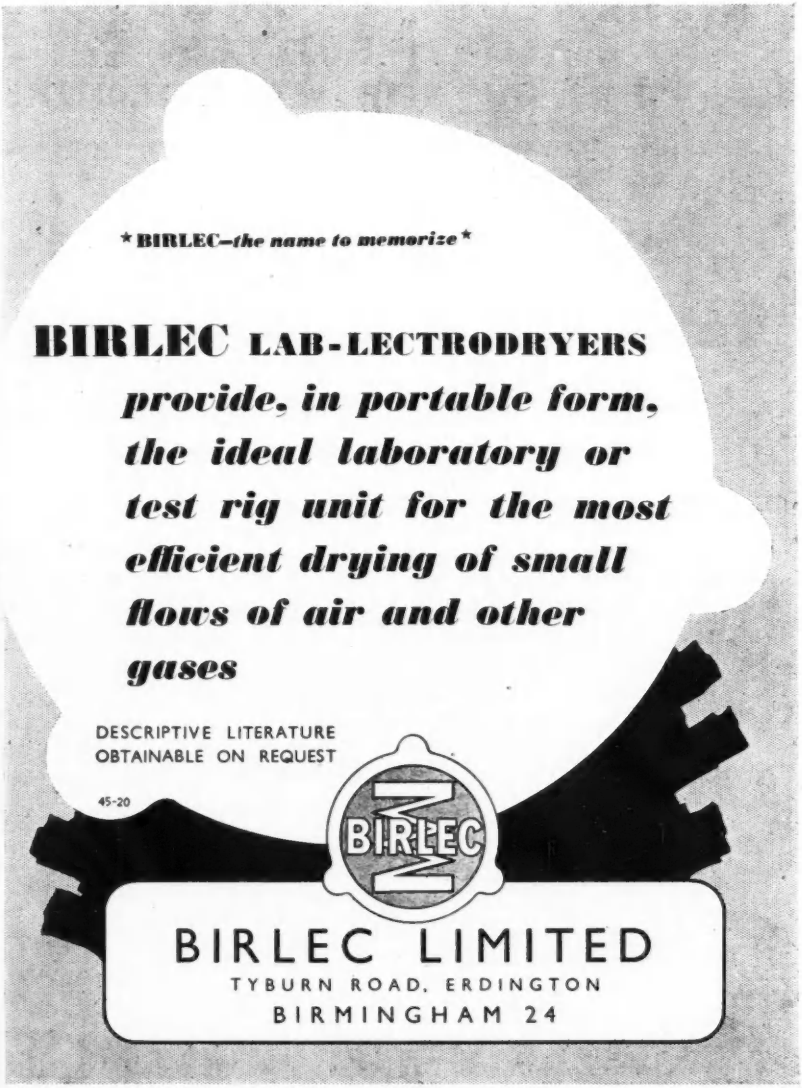
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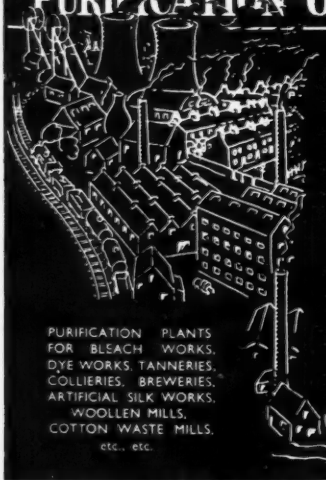

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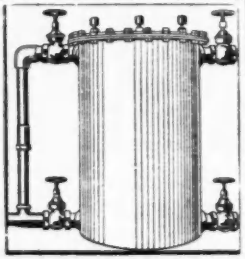

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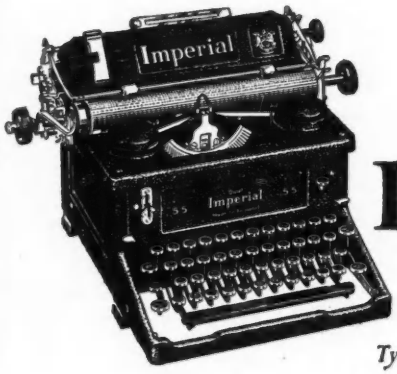

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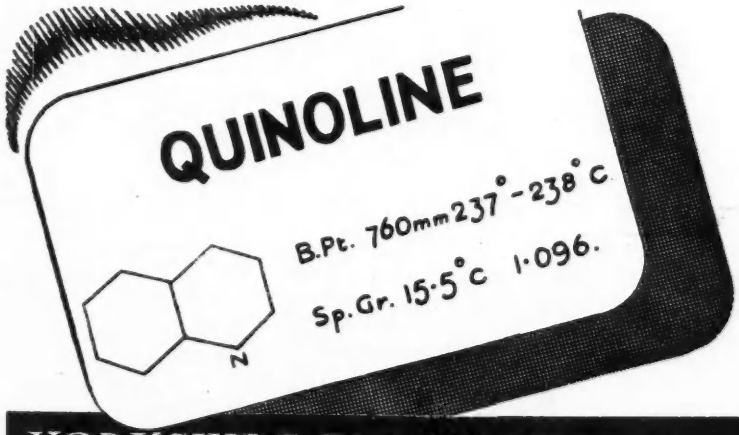

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No. 1367. — September 8, 1945 — Annual Subscription 21s.
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A Voice from America

THERE is no more democratic country in the world than the United States of America. It is vast, it has a vast population, it believes in private enterprise; but, as such ventures as the Tenessee Valley Authorities show, it is not afraid of State-owned enterprise within reasonable limits. It would be very useful if there were more interchange of views between America and this country. We are all prone to live in our own circle and it is often useful to know what is said by those who have similar problems to face under other conditions in other parts of the world. There is a great deal published in every country which should be read by those in other countries. In the technical sphere and in scientific work this has long been acknowledged as proved beyond doubt. No research worker would think of starting a new series of researches unless he had first obtained access to everything which he could find that had been written about this subject in every country. He takes the full sum of human knowledge into account and then decides in what direction it should be extended. It is curious that in the world of politics and in many other directions each country lives very much to itself, and those who through their votes or more directly, have some say in the destinies of the nation do not seem to find it necessary to acquaint themselves with thought in other fields before rushing with their parochial ideas on to ground where the informed might well fear to tread.

This country is in a very difficult position, a position which to some extent was paralleled after the last war Costs have increased, and unless they are decreased we cannot compete in the export market. There is much the same explosive situation between labour and capital as existed after the last war. If the detonator is fired, it will be to the advantage of no one save Britain's enemies. Should labour demand a 40-hour or even a 36-hour week? Should labour demand higher wages? Should management ask labour to accept lower wages and higher hours? Should we embark upon great social services? If so, how should we finance them? Should we embark on schemes of nationalisation or should we retain private enterprise? The Labour Government will have to face these questions just as certainly as a Conservative Government would have had to. Whatever Govern-

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ment is in power or whoever makes demands for higher wages or lower costs it cannot be denied that this nation can exist and remain prosperous only for as long as its industry is prosperous. It is of no use embarking on schemes engendered by political ambitions if there is behind them no certainty that they will increase the efficiency or reduce the costs of British industry. In war we stand or fall together as a nation; so it is also in peace.

An important article has recently come to our notice, written by Edward J. Meeman in the *Memphis Press-Scimitar*, which we feel should be brought widely to the notice of Britons to-day. In the opinion of this writer the real division of interest is not between capital and labour, between employers and labour unions; the real division is between *liberal* businessmen and *liberal* labour union men on the one hand, and *illiberal* businessmen and *illiberal* labour union men on the other. We need not waste very much time in discussing what the author means by "illiberal" businessmen and "illiberal" labour men. They are those who are guilty of self-seeking and of sharp practices that would be condemned by their more enlightened fellows. In this category are the employers who adopt any form of unfair competition, who grind down labour by low wages and long hours and who oppress the workmen. These are they who cheat the consumer by inferior and over-priced products, who hoodwink the investor, who bribe and cajole their way into a fictitious prosperity which they would secure by unfair means. These are the labour leaders who believe that the workers should be the slaves of the trade unions, who believe that everyone should be so dependent on his union that it is difficult or impossible for him to change his job, who abuse the power of the unions and who "use political power for selfish advantage of labour instead of for what is fair to everybody."

Such practices are not unknown in this country, unfortunately, but we hope that they will wilt and die in the light of public opinion. Here is what Mr. Meeman has to say in regard to what "liberal" businessmen and "liberal" trade unions should be.

"The liberal business men were not afraid of competition. They said: 'Let that business win which serves the public best.' They said: 'Certainly, labour has the right to organise to protect the interests of workers, just as we business men organise.' They saw that working men with high wages would be good customers. They made an honest, full-value product, and priced it as low as possible, saying: 'We will make our profit through volume of sales.' They told the truth about their business in their labels and in their advertising, and gave investors an honest statement. They would not seek or accept favours from Government, believing that Government should be one of laws which apply equally to all. Moreover, they thought that Government should be kept as simple and economical as possible lest it become an oppressor of the people and a burden to the taxpayers. They favoured free trade so that other nations could prosper; so that nations would regard each other as customers and friends rather than rivals and enemies.

"The liberal union man fights hard to get more money and better conditions for the worker, but he never hurts the business he works for because he knows its the cow that gives the milk. He does everything he can to make the business more prosperous, for he knows that the more it prospers the more money he will have the right to ask for. He works as hard as he can and does the best job he can, and he expects the employer, in the same spirit, to pay him all he can afford to pay him. He doesn't want to destroy capital, for he knows that if there were not private capital to employ people, then everybody would have to work for Government—and wouldn't that be hell? He wants wage workers well paid so they can save and buy stock in the company they work for, and in other companies, and become capitalists, too. He thinks it would be fine if every worker were a capitalist and every capitalist a worker. He thinks it would be good to have some extra private income in old age so as not to have to depend entirely on a Government or company pension. He thinks labour unions should have justice, not special privileges, from Government."

NOTES AND COMMENTS

Science and the State

ON the familiar principle usually applied to swings and roundabouts, those industries which are to any extent dependent on, or interested in, scientific research, may find their position materially improved under a Socialist Government. In other countries, when State supervision and support has been accorded to research, the industries concerned therewith have quite distinctly benefited. Many Socialist leaders have expressed the opinion that industrial scientific research should be officially encouraged, and they have been inclined to favour the international interchange of ideas among scientists. It is probable, under the present régime, that we shall be spared a repetition of that lamentable business of the scientists' visit to Russia a few weeks ago. Professor A. V. Hill, one of the secretaries of the Royal Society, has voiced his opinion of that unsavoury business in no uncertain terms in a letter to *Nature*, and now *Discovery* asks why there has been no official denial of the story that strong pressure was put upon the Australian Government by the British Foreign Office in an attempt to prevent them from sending Professor Ashby to Moscow as a scientific attaché. We are by no means in unqualified agreement with much of the Socialists' programme, but we submit that this interference with science by the methods of backstairs diplomacy is a form of political pressure which they are not likely to employ.

Electric Power in India

IT is announced that a project for the economic development of the Damodar River Valley in Bihar and Bengal is to be investigated. A project has been presented by the Central Technical Power Board, involving the construction of a dam for the generation of hydro-electric power, similar to that of the Severn Barrage scheme, which was dealt with in THE CHEMICAL AGE of March 17. The Damodar Valley contains most of the coal resources of India and is particularly suitable for industrial development. The project, which is expected to cost about £41,000,000 (which may be compared with a cost of £47,000,000 for the Severn Barrage scheme), entails the irrigation of large areas of land, which would not only be an insurance against famine, but would increase considerably the agricultural production of the valley. About a year ago, a British technical mission visited India to advise on the production of artificial fertilisers. Its recommendation, published by the Government of India, was to adopt the semi-water-gas process, using Bihar coke which is available in the required quantities. It thus appears likely that this district of India is to be intensively developed.

A TVA for India

AT present, there is capacity for the generation of electric power in the Damodar Valley of approximately 137,000 kW. The project envisages an intricate system of hydro-electric thermal power stations, with a generating capacity of 350,000 kW., generating at a substantially lower cost than that at present entailed. On the basis of 8000 hours per year in full operation at the rate mentioned, this would amount to 2800 million kWh per annum (which again can be compared with the Severn Valley proposal for a total of 2100 million kWh per annum). Bearing in mind the importance of cheap electric energy for the country's development, the proposal has been made to operate the Damodar Valley scheme in a manner similar to that of the Tenessee Valley Authority.

Coal Wasted

IN view of the acute coal position in this country, and the coal famine on the Continent, we should have thought that every step would be taken in this country to reduce any wasteful consumption of this valuable national asset. The chemical industry has certainly played its part in ventilating this burning question. In spite of all, however, a statement made by the National Smoke Abatement Society reveals a perturbing state of affairs as regards the installation of improved fuel-burning appliances in Britain's new houses. In spite of considerable advances in design, a great number of new houses are being fitted with appliances of an obsolete type and of inferior efficiency. The Society esti-

mates that the wastage of coal will be as high as one ton per house per year, which is equivalent to raising the rent by 1s. 6d. a week. The smoke evil will be intensified and, furthermore, once outmoded burning appliances are fitted there is mighty little hope of their early replacement. It is plain that this problem, which so closely affects not only the national economy, public health, and amenity, but the cost of living, the comfort, and the amount of domestic work to be done in every house, has been grossly neglected, both in planning and execution.

Publication of Discoveries

A DEMAND that full and free publication of scientific discoveries be permitted has been advanced by Professor J. W. Cook, F.R.S., of the Chair of Chemistry in the University of Glasgow. Writing to the *Glasgow Herald* on "Science in Relation to State and Society," Professor Cook says: It is important to safeguard the tradition of free and unrestricted publication of technical details of scientific discoveries. The scientist has always regarded such publication as a duty as well as a privilege, and has been prepared to contribute his quota to its cost. Not the least of the advantages of free publication is the stimulation and inspiration which is provided by critical discussion of new advances. It is now being suggested that some authority should undertake to suppress publication if the discovery is deemed likely to be of danger to society. Again, it may be asked, who is to be entrusted with this responsibility, what useful purpose would it serve, and what criterion is to be applied? It is not knowledge which is to be feared, but ignorance. In the Prime Minister's recent statement on the atomic bomb it was made clear that its production and use are to be controlled. Few would dissent from this decision. But it is to be hoped that any new scientific knowledge which has been acquired during the development of the bomb will be made freely available to those able to profit by it.

Plans are under way in the U.S. for the import of about 25,000 tons of titanium from Norway, the first imports from that country in six years.

International Aluminium Co.

Activities Drastically Reduced

THE annual report of the International Aluminium Co., Ltd. (a subsidiary of Alliance Aluminium Holdings, Ltd.), reveals that its activities were drastically curtailed in 1944. The alumina works at Hebburn-on-Tyne had to be closed in May last and cannot be re-started economically. As a consequence, the company ceased trading at the end of last year. Its main assets are the shares held in its Norwegian subsidiary, A/S Hangvik Smelterverk, the works of which are reported to be intact, though no arrangements have been made as regards future operations.

The report of the Aluminium Corporation, which is also controlled by the above holding company, states that during the war the company produced aluminium at Dolgarrog by temporary power supply arrangements. This supply was discontinued in March last and production therefore came to an end. The furnace plant has been dismantled, but no change has occurred in the operation of the rolling mills at Dolgarrog.

N.F. METALS CONTROL

The Ministry of Supply has released the present Joint Controllers of Non-Ferrous Metals, Mr. W. Mure and Mr. A. M. Baer, from their duties from August 31, on which date the agreement of 1940 between the Ministry and the British Metal Corporation, Ltd., terminated. The Control will be replaced by a Directorate of Non-Ferrous Metals under the Raw Materials Department. The Director will be Mr. R. D. Burn, at present Deputy-Controller of Non-Ferrous Metals, and the Directorate will operate from the same addresses as the Control: Grand Hotel, Rugby, Warwickshire (Telephone: Rugby 2131), and Euston House, Eversholt Street, London, N.W.1 (Telephone: Euston 1260). Mr. G. F. A. Burgess and Mr. R. E. Talbot also relinquished their positions as Deputy-Controllers of Non-Ferrous Metals on August 31, but Mr. Burgess will continue for the time being to act as Controller of Mica.

The Ministry of Supply announces that as from August 31, applications to the Directorate of Non-Ferrous Metals for licences to acquire copper, nickel and zinc for the production of semi-manufactured or manufactured goods, whether for the home trade or for export, will be considered by the Directorate without restriction in respect of the type of article to be manufactured. Inquiries should be made to the Director, Directorate of Non-Ferrous Metals, Grand Hotel, Rugby.

FUEL EFFICIENCY IN THE CHEMICAL INDUSTRY

Fuel Economy Discussions

VI.—Inhibition of Corrosion of Metal in Contact with Water and/or Steam

by W. MURRAY, A.M.C.T., F.R.I.C., F.C.S.

BEFORE discussing methods of inhibition of corrosion of metal, it would be as well to give some consideration to the reason for the occurrence of corrosion and its mechanism. I think it cannot be overstressed that when we try to inhibit the corrosion of metals we are attempting to interfere in the orderly progress of a vast natural force. Let us recall that practically all the metals used in industry occurred originally in combination with oxygen, carbon dioxide, or sulphur, as oxides, carbonates, and sulphides respectively. The fabricated metals, which are in a metastable state (or in what one might say is an uneasy balance) are then put into service where the old-time partners are available for reunion.

Electrolytic Corrosion Theory

Many theories have been put forward from time to time to explain the mechanism of corrosion, knowledge of which is essential if effective inhibition schemes are to be devised. It is not proposed to go into these theories, but simply to emphasise the favourable conditions which abound for the generally accepted theory of corrosion electrolytically. We must remember that: (a) Water is the universal solvent and is never found in nature in the pure state—it always contains dissolved gases and salts, the identity and quality of which vary from place to place and point to point; and (b) no metal is entirely insoluble in water.

Electrolytic corrosion involves the replacement of hydrogen from water by the metal being corroded. Two reactions take place simultaneously: somewhere in the system metal is dissolved at anodes and hydrogen is evolved at cathodes. The surfaces of all metals must be considered as comprised of anodic and cathodic areas forming local couples. These areas may be formed, for example, by segregation of the constituents of alloys, local stains, and contact between dissimilar metals, differential aeration and the presence of salts in solution.

In Fig. 1 the standard potentials are referred to 1 atmosphere of hydrogen at 25° C. The standard E.M.F. series, is, however, not directly applicable. As shown in Fig. 1, a metal becomes more "noble" by 0.059/N volts for each tenfold change in the concentration of its ions at 25° C., *e.g.*, silver is cathodic (*i.e.*, more "noble") to copper at high concentrations of silver and copper ions, but changes its relative position at low concentrations of the respective ions.

Some confusion has also existed in understanding the relation between hydrogen in the standard E.M.F. series and the standard potentials given for metals. It is assumed that if the potential of a metal is above that of hydrogen, it is more subject to corrosion. When it is realised, however, that normally hydrogen exists at pressures much below

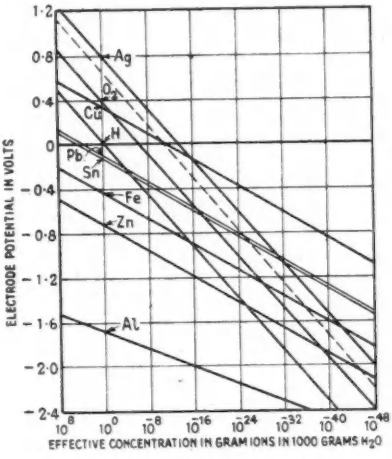

Fig. 1. E.M.F. series.

atmospheric, it can readily be seen that corrosion can take place by hydrogen displacement. Reference to the graph shows that hydrogen becomes cathodic as the pressure decreases, exhibiting a change of 0.029 volts for each tenfold change in the hydrogen pressure. Another important point to bear in mind is that the presence of oxides on the surface of metal causes a displacement in the E.M.F. series.

Typical Examples of Corrosion

(a) *Steam Heating System.* The occurrence of corrosion in condensate return lines, where all precautions have been taken against "carry-over" of salts in the steam is familiar to most of us. Fig. 2 is an example of pitting corrosion in a 1-in. diameter mild steel

pipe on the return side of a steam-heating system after only 6 months in service. The make-up water was town supply and there was no contamination. The condensate was acidic, due to carbon dioxide dissolved in the

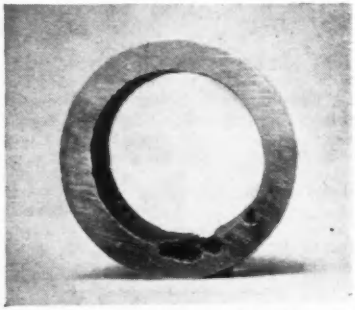

Fig. 2. Pitting corrosion in mild steel pipe.

water, and there was also oxygen present. The oxygen is important since it has been shown that carbon dioxide is innocuous in its absence.

(b) *Calorifiers.* Recently, our attention was drawn to a calorifier installation where there was corrosive action on the copper tubes in the cast-iron bodies of two calorifiers only, while several others appeared to be unaffected. At first sight it would appear, according to the rules of galvanic action, that the copper should be sacrificially protected at the expense of iron, but bearing in mind the points which have just been made about the interpretation of the E.M.F. series and also such important things as plant lay-out, comparative effectiveness of trapping of steam lines, occurrence of dew point, temperatures, etc., it will be agreed that it is difficult to decide which particular corrosion mechanism has been responsible, or whether there has not been more than one cause of the failure.

Examples of Successful Inhibition

Some interesting cases of the occurrence of corrosion and its inhibition will now be described:

(a) *Circulating a Soft Corrosive Water (Manchester Town Supply) through a Cooling System.* Fig. 3 shows a diagrammatic layout of a platen press. The main construction is steel, but the connections for cooling water and steam (used alternatively) are in non-ferrous metals. For a predetermined period steam is passed through the jackets while the process materials are being pressed. Then the steam is shut off and cooling water is passed through the jackets. With the first press which was installed, the cooling water passed to waste, but in the second plant the cooling water was re-used. This water was then cooled in atmospheric cooling towers. No corrosion of any moment occurred in the once-through cooling water system, but corrosion was soon rife in the circulating water system. The non-ferrous couplings became brittle and at every bend in the pipe line from the press to the cooling tower, severe corrosion occurred resulting in perforation of the tubes. A typical bend is shown in Fig. 4. Replacements were numerous and costly, apart from interfering seriously with production.

Analysis of the cooling water revealed that it was acidic, due to presence of CO_2, and also contained 6 ml. per litre of O_2, *i.e.*, near saturation at atmospheric temperature. The corrosion was, and has since been, completely arrested, for practical purposes—*i.e.*, no breakdown after 3 months' treatment—on the following lines: (1) elevation of *p*H value to 9.6 by caustic soda; (2) incorporation of

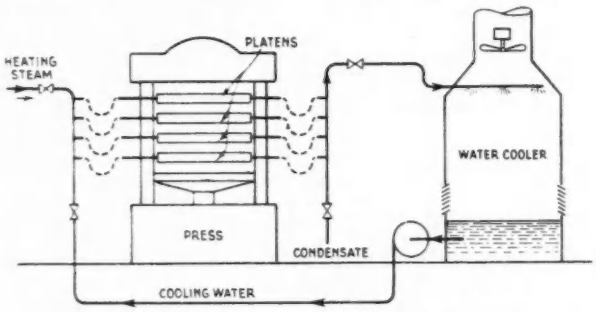

Fig. 3. Cooling water circuit for platen press.

sodium chromate at the rate of only 1/10 lb. per 1000 gallons of water in circulation, and at the same rate for make-up water.

This amount of inhibitor is very much lower than that necessary according to re-

quirements by theory and laboratory experiments. This successful application of sodium chromate at much less than the theoretical rate is considered as highly important, because it has been stated in many quarters that if chromate is used at less than the theoretical amount the corrosion is increased. The speed and agitation of the water probably play a large part in determining the quantity of chromate required.

(b) *Corrosion on the Water Side of a Loco Boiler Tube.*—A potential scale-forming and corrosive water was used as feed to a number of locomotive boilers. Trouble was soon experienced with tube failures and heavy scaling, and later an internal system of water conditioning was employed. This treatment, based on physical and chemical principles, was not used to the extent recommended, and in due course a report was received saying that, although new scale formation was being prevented and some disintegration of old deposits was observed, perforation of tubes continued. With this report was sent what was stated to be the only piece of one tube that showed a hole and one area of pitting. We examined the tube and at first sight there did appear to be only one hole and one area of weakness 4 in. from the hole just mentioned, but closer examination revealed several small corrosion pits. Steps were taken to remove what appeared to be old hard scale about 1/32 in. thick which occurred only in patches, but was most adherent to the metal. The cleaned metal surfaces then showed up as in photomacrographs. The corrosion was much more widespread than that assumed at a first inspection.

Our conclusions were that, in the first instance, the oxide film on the tube had not been sufficiently adherent to prevent rupture (this is, of course, the great trouble with oxide film). Once the oxide film had been broken there was an electro-potential difference between the metal which was covered with oxide film and that which was bare, and the anodic part, *i.e.*, the bare metal, had been attacked. As time went on, the electro-potential difference was further aggravated by unequal depositing of boiler scale, and in this instance the metal under the boiler scale, regardless of oxide film, suffered corrosion. Apart from the general wastage and pitting corrosion on the bare metal, there was also pitting on the parts of the metal covered by oxide film, which supports this second statement. The position was remedied by adding sufficient alkali to prevent scale formation, to disintegrate the existing deposits, and to elevate the *p*H value of the water to a figure between 9.6 and 11.0.

Present Water-Treatment Practice

So far as water treatment is concerned, the first thing to ensure is that there is no contamination of the water supply by trade effluents, sewage, and so forth. Other measures are:

(a) *In Cooling and Heating Systems*

(1) Correct any acidic tendencies due to aeration in polluted atmospheres. This is most economically effected by addition of caustic soda.

(2) In a closed or nearly-closed system, keep the *p*H value of the water up (the exact *p*H value will be dependent on the metal used in plant fabrication) and aim to have the water thoroughly de-aerated by

Fig. 4. Severe corrosion at a bend in a pipe-line.

using a chemical such as sodium sulphite. The use of selected tannins along with the sulphite is advised because of their absorptive capacity for gases and property of film formation. All reasonable precautions should be taken against air in-leakage.

(3) In an open system, *i.e.*, where at one point the water is cooled by spraying in the atmosphere or air is blown through the water, keep the *p*H value up by addition of caustic alkali and add a chemical (soluble in water) rich in oxygen, such as sodium chromate or dichromate.

(b) *In Boiler-Water Feedlines*

Elevation of *p*H value alone is often found effective, but if not, the addition of tannins usually gives all the protection required. In elevating the *p*H value, one must be careful not to cause heavy, uneven deposits (due to the breakdown of temporary hardness), which might give rise to the formation of anodic and cathodic areas with consequent electrolytic corrosion. Sodium hexametaphosphate will prevent such happenings.

(c) *In Economisers (Cast-Iron)*

Where soft feed-waters are in use, graphitic wastage is a frequent trouble. The extent and speed of the wastage really determines the stringency of the water treatment. Ele-

vation of *p*H value plus tannin often overcomes the difficulty, but if this is not successful, then:

(1) If the amount used justifies it, the water should be de-aerated by mechanical means.

(2) If the volume of water is relatively small, the de-aeration can be achieved by employing sodium sulphite.

(d) *In Boilers.*

(1) Keep the *p*H value above 9.6

(2) Keep the boiler metal surfaces free from deposit.

(3) If in spite of (1) and (2) corrosion still proceeds, it will be found necessary to de-aerate and this can be done either chemically or mechanically—the choice is governed by economics.

(e) *In Steam and Condensate Lines.*

(1) Run the boilers in such a way that priming and foaming is avoided and that there is the absolute minimum carry-over of solids. To do this, attention is necessary both to the method of working the plant, and to the condition of the boiler water.

(2) Provided that the conditions under (1) have been maintained and assuming that there has been no contamination of the water supply, it can be taken that any corrosive activity is due to the presence of carbon

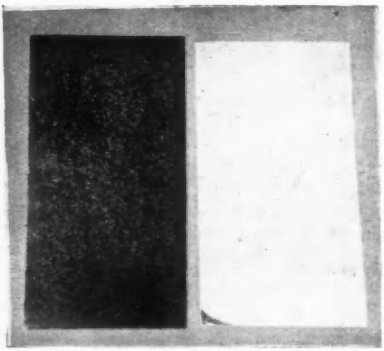

Fig. 5. Polished steel specimens : (l) exposed to Liverpool atmosphere ; (r) encased in muslin.

dioxide and oxygen. Before taking steps to remove both or one of these gases it is as well to satisfy oneself on (a) the proper trapping of the steam lines, and (b) the avoidance of pockets where condensed steam can lie, as it has often been found that attention of such things has completely overcome the corrosion which hitherto existed.

It has been stated earlier that in the absence of oxygen, carbon dioxide will not attack metal, and it is a matter of economics and facility which determines whether one should remove all the potential carbon dioxide, *e.g.*, present as temporary hardness, by treatment with lime prior to the water entering the boiler, or to add sufficient sodium sulphite to the water to take up all the oxygen so that none goes forward in the steam. There are, obviously, practical difficulties in the latter course if the pressure in the steam range drops to zero, so causing in-leakage of air. Another method which has been suggested is that of introducing caustic soda in the steam range to take up the carbon dioxide and elevate the *p*H value of the condensate, but unless the application is under strict control, it might lead to greater difficulties.

The Future

So much for present practice, but much more is required. I suggest that next to coal conservation (and we must not overlook the coal consumed in obtaining our metals) comes the necessity for increasing the life of the fabricated metals. There is no doubt that in many instances the present methods of water treatment for the inhibition of corrosion are effective, but there are many unsolved problems or at least problems in which no cures sufficiently low in cost are at hand.

To my mind, insufficient attention has been given to the great work by Vernon, Evans, Bengough and others. Bengough, for example, has shown the way in which the natural protective film of aluminium can be increased, and this has been successfully applied. Vernon has demonstrated how natural protective films can be obtained on metal surfaces in humid conditions, provided that soot and dust particles do not fall on the surface. His results are easily reproducible and Fig. 5 shows the appearance of polished specimens of steel, one of which was encased in muslin to prevent deposition of solid airborne particles and the other exposed to the normal Liverpool atmosphere. Dr. Vernon tells me, in a private communication, that he raised the question as far back as 1927, as to what extent these invisible oxide films might afford a better "anchorage" for subsequently applied coatings or treatments, and it was with this in mind that I started a series of experiments.

The position at the moment is that I am subjecting specimens of a steel of known history, half of which have been previously protected by muslin and the other half exposed for a period of 6 weeks to a corrosive water; *e.g.*, Liverpool town supply, and introducing various inhibitors. The questions arising are: (1) whether one can build up a protective film on the metal by water treatment for a certain period and then have a strengthened film which would be completely protective for all practical purposes; and (2) in the case of the metals which have had no protection (as is the present-day practice), can one employ a water treatment which will strip the metal free from the first products of corrosion formed and then build on to the

surface of the good metal? Alternatively, could the water treatment be such as to bind the first products of corrosion together so that further corrosion is prevented?

I am sorry that the work is not sufficiently advanced for me to give any answer to the questions raised. A considerable time is bound to elapse before one has even exhausted the experiments which could be carried out on steel and the time which will be required for a proper survey of all the metals commonly used appears most formidable.

Bearing in mind the way in which the research work on the protective film on aluminium has been developed, it does seem that there is the need for a nation-wide research programme on similar lines (based on the work of the research men mentioned earlier), combined with the fullest co-operation on the part of the metal industry and the metal user. We could then look forward to the possibility of obtaining some relatively simple effective and economical safeguards against the terrific wastage of metal, with its resultant inefficiency, at present occurring in plant practice.

(To be continued.)

U.K. Consulting Chemists

Directory in Preparation by R.I.C.

A DIRECTORY of independent consulting chemists in the United Kingdom is being prepared, according to an announcement contained in the *Journal* of the Royal Institute of Chemistry. The directory will contain an indication of the general scope of the activities and of any particular fields in which the consultants specialise.

The directory will be an annual publication, and will be on sale to the general public. A form has been prepared on which consultants are asked to insert details with regard to their practice and field of work.

It is felt that the directory will prove of much value to manufacturers and others in view of the time often wasted in obtaining the best advice and assistance on current problems.

Combined Board's Future

Review of Operations

THE Governments of Britain, U.S.A., and Canada have decided that the Combined Production and Resources Board, Combined Raw Materials Board and the Combined Food Board will continue, for the time being, to operate on the existing basis.

This is to ensure that there is no breakdown in the combined machinery which is handling various critical supply questions of immediate importance. The Governments will also arrange without delay to determine the necessity for continuing its operation.

DDT Supply Position

Small-Scale Civilian Releases

DDT is still wanted in large quantities for the protection of British troops in Europe and Asia from typhus and malaria. Although it has been possible to cancel certain Army contracts for stores containing DDT, material thus saved has to be diverted to other Service uses. Until our armies in the field are substantially reduced, most of the DDT now being produced in this country will be shipped overseas.

For some considerable time, however, the Ministry of Supply has arranged for the trade to have ample quantities with which to carry out experimental work and to develop prospective markets. Arrangements have now been made for the release of DDT on a small scale for the manufacture of insecticides for general sale, but primarily for export. Distribution will be through the normal trade channels.

New Control Orders

Benzol and Toluene

THE Control of Benzol and Allied Products Order, 1945 (S. R. & O., 1945, No. 1064), consolidates the Control of Benzol and Coal Spirit Order, 1944, the Control of Benzol and Coal Spirit (No. 2) Order, 1944, and the Control of Benzol and Coal Spirit Order, 1945.

The control of the disposal and acquisition of toluene is brought within the scope of this Order (*see* below). Control is now regulated by acquisition licences but will, under this Order, be regulated by disposal licences. The quantity which can be disposed of and acquired without licence will be 50 gallons in each quarter, beginning with the quarter starting on October 1, subject to a limitation of 30 gallons as between the same supplier and buyer.

The amount attributable to the cost of refining once-run benzol, and profit in respect thereof, as regards the calculation of the maximum price for normal crude benzol, is increased by .15d. per gallon.

Examples of price calculation for the sale or supply of crude benzol, revised in accordance with the increases in prices provided for by the Control of Benzol and Coal Spirit Order, 1945, and continued by this Order, are given. The Order came into force on September 1, and does not extend to Northern Ireland.

The Control of Toluene (No. 6) (Revocation) Order, 1945 (S. R. & O. 1945, No. 1056), made by the Minister of Supply, revokes the only subsisting Order of the M.O.S. under the title "Control of Toluene." Henceforth, the control of toluene, etc., will be exercised by the Minister of Fuel and Power.

Indian Notes

Progress in States and Provinces

A SUMMARY of the recommendations on post-war plans made by the Central Provincial Industries Committee, presided over by Mr. P. S. Rau, has recently been received in this country. The committee has made a survey of the mineral, forest, and other resources of the Province and has recommended the establishment of various industries based on available raw materials.

Central Provinces Development

The Government should take immediate steps to explore the possibilities of establishing an iron and steel industry in the Chanda and Drug Districts, and also an aluminium industry in the Katni area. The mining of the enormous resources in manganese is now the monopoly of one single concern. The committee fears that, at the present rate of exploitation, the resources may not last longer than 20 or 30 years. It recommends that mines should be taken over by the State and the export of the mineral should be restricted.

Dealing with industrial chemicals, the committee favours the establishment of an ammonium sulphate factory in the Katni area, and also factories for the manufacture of nitric acid, bleaching powder and caustic soda.

The establishment of factories for the manufacture of vegetable ghee, soap, and other products based on oilseed is being suggested, as well as the establishment of three modern tanneries.

Jodhpur Plans

In Jodhpur, a Department of Industries and Commerce has recently been established, and, in order to survey the mineral resources of the State, the services of a geologist have been obtained.

For the manufacture of heavy chemicals from Sambhar lake bitterns, a joint company with a capital of Rs. 2 crores is in the process of formation, and it is further intended to establish a cement factory, as excellent quality of limestone, gypsum and slate stone are available. Among the other industries, the Government has prepared schemes for the manufacture of glassware, pottery, tanning, matches, and paints and varnishes.

From Madras comes the news that the Government of Madras has sanctioned a scheme for the systematic survey of the clay deposits in the Nellore and Cuddapa districts. The object of the survey is to assess the importance of known deposits and to discover new deposits of clay and other raw materials needed for the projected model ceramic factory at Gudur.

That food yeast can be manufactured in India cheaply and on a large scale, that its use as a corrective for malnutrition should be encouraged by the Food Department, and that a factory with a capacity of 3000 tons per annum should be started immediately, are some of the recommendations made by the Food Department, in a report now being considered by the Government. It is estimated that the cost to the consumer will be not more than 6 annas per lb.

Details have now been received regarding the following research schemes in chemistry and metallurgy, sanctioned at the eighth meeting of the governing body of the Council of Scientific and Industrial Research, held in New Delhi.

Scientific and Industrial Research

New research schemes have been worked out for the utilisation of bauxite deposits of Central Provinces; the chemistry of penicillin and related substances; and the utilisation of waste products of sharks.

Extended grants have been approved, *inter alia*, for the production of high temperature refractories used in the glass industry, and for the manufacture of optical glass.

At the Indian Institute of Science at Bangalore, Sir J. C. Ghosh will investigate the manufacture of synthetic methanol, as well as the purification of natural graphite ores and the preparation of graphite lubricants. A survey of research problems on electro-chemical industries will be in the hands of Dr. D. Swarup in Benares. Other subjects to be investigated include the fermentative production of butanol, acetone, and solvents, and acids from molasses, and the production of industrial enzymes, as well as of gelatine.

As regards subjects for metallurgical research, reference should be made to investigations into the manufacture of permanent magnet steel, to pilot plant experiments on the manufacture of metallic sodium and magnesium, and to work on the preparation and testing of aluminium-titanium alloys.

Owing to India's leading position as a producer of mica, the proposed work on the utilisation of waste mica in Bihar deserves attention. The Mysore Iron and Steel Works will continue to work on the manufacture of resistance alloys.

The creation of a Central Plastics Research Institute, at a capital cost of Rs. 20 lakhs and a recurring annual expenditure of Rs. 4 lakhs, was recommended at a recent meeting of the Indian Institute of Science, reports *Science and Culture*.

Recent Developments in Analytical Chemistry—XV

From Our Analytical Correspondent

THOSE interested in historical aspects of analytical chemistry will find a review[1] of the development of the well-known method for the detection of nitrogen in organic compounds—Lassaignes Test—stimulating. It is of interest to observe that although many modifications have been proposed from time to time, the test, as widely used, still depends essentially on the same principles as that originally proposed. The method of operation, as used for teaching purposes in the author's laboratory, is described in detail.

Frings[2] claims that when testing for ammonium ion by the liberation of ammonia, alizarin test paper is to be preferred to litmus as an indicator of the presence of the liberated gas. Filter paper or spot paper is soaked in a saturated ether or methyl alcohol solution of alizarin and allowed to dry. For use it is moistened with water. The action of ammonia changes it from light yellow to purple, so that the change is easily observed, as little as 5 μg. of ammonium ion giving a definite test. Where spattering by caustic alkali is suspected, this may be proved or disproved merely by drying the indicator paper. The colour change caused by ammonia reverses to the original light yellow colour, while if the cause be caustic soda or potash the colour change to purple is permanent.

Determination of Nitrogen

Sobel and his co-workers have worked out methods for the determination of ammonia or Kjeldahl nitrogen, both on the micro scale and on an ultramicro scale. For the micro procedure,[3] the nitrogen is converted to ammonium salt, decomposed, and aerated from the container into a serum tube containing boric acid, followed by titration against 0.01 *N* acid. This method gave an average error of −0.5 per cent., while the precision was ± 0.8 per cent. The usual quantity of nitrogen involved was 1-2 mg. This basic method has been modified to an ultramicro scale capable of determining 10 μg of nitrogen with an error of ± 0.1 per cent., and a precision of ± 1.3 per cent.[4] The sample (*e.g.*, 0.01 ml. of serum) is decomposed in a side-arm test-tube, using a conventional sulphuric-acid/potassium-sulphate/copper - sulphate/selenium digestion mixture. After the decomposition and conversion to ammonium salt is complete, a little water is added, followed by alkali-thiosulphate solution, and air is then drawn through the solution and bubbled in turn through boric acid solution containing bromocresol-green/methyl-red indicator. This solution is held in a second side-arm test-tube. After passage of the air stream for 20-30 minutes, the receiver is disconnected, and titrated with acid from a capillary microburette of a modified Rehberg[5] type. The titration is continued until the boric acid reaches the original *p*H, as indicated by a standard tube containing boric acid and indicator only.

Nitrogen in Nitriles

Nitrogen in nitriles can be determined[6] by a preliminary reduction with hydriodic acid, followed by a Kjeldahl reduction. The hydriodic acid is produced *in situ* by the action of sulphuric acid and potassium iodide. Such a method is preferable either to the Dumas method or to the sealed-tube methods which are usually applied in the case of nitriles. The reduction is followed by the normal Kjeldahl determination, using copper-sulphate/selenium catalyst, and the ammonia is trapped in standard sulphuric acid. This is back-titrated against sodium hydroxide, the indicator recommended being sodium alizarin sulphonate/indigo carmine.

The estimation of total nitrogen in proteins and their hydrolysates, on the semi-micro scale, has been dealt with by Jonnard.[7] A special distillation head, devised to avoid hold-up of liquid (and hence of ammonia), and to avoid losses in transfer from the digestion flask, has been devised by the author. Various catalysts have been tested for improvement of the digestion procedure. The catalyst and digestion mixture finally chosen consists of 1 ml. of 57 per cent. hydriodic acid, 3 ml. of concentrated sulphuric acid, and 100 mg. of potassium sulphate for every 5 mg. of anticipated nitrogen. One ml. of 1.2 per cent. solution of selenious oxide in concentrated sulphuric acid is added after the first hour of digestion. It might here be pointed out that, although the author is guided to some extent in his choice of method by the results of previous workers, he makes a number of questionable statements in reviewing this earlier work. For example, he refers to the catalyst investigated by Best, Belcher and Godbert (selenium/mercuric sulphate/potassium sulphate) as a modification of Wagner's digestion mixture, although the paper of Beet and Belcher, which he quotes in this connection[8] is dated 1938, and that of Wagner[9] two years later; and, indeed, the catalyst was first described by Beet[10]. Again, it is misleading to say, as he does,

that these authors found the use of hydriodic acid for the preliminary reduction of difficultly digestible compounds time-consuming, since, in fact, they recommend the method for semi-micro work.

One valuable point mentioned in the articles is that the digestion time for complete nitrogen recovery is independent of the decolorisation of the contents of the digestion flask, so that many substances require the digestion period to be continued long after the mixture goes clear. Most organic text-books are unanimous in perpetuating the erroneous use of this decolorisation as an indication of complete conversion, and it is well to bring to the general notice that this is far from correct, and that an afterboil is necessary. As routine practice for semi-micro Kjeldahl determinations[11], a digestion period of at least 45 minutes is advisable. In Jonnard's investigations with highly resistant compounds much longer digestion periods are necessary —although the preparation decolorises rapidly.

The determination of small amounts of nitrate may be conducted by reduction with Devarda's alloy, and absorption of the ammonia in boric acid[12]. The sample is placed in a special vacuum-jacketed flask which is heated electrically by a small coil wrapped round the end of the flask inside the vacuum-jacket, thus ensuring even heating. A vacuum-jacketed spray trap, filled with glass-wool, is also included in the apparatus. The boric acid in which the ammonia is trapped is subsequently titrated against 0.01 *N* hydrochloric acid to the end-point with bromocresol-green/methyl-red indicator. Simpler apparatus than that described by the author may be constructed from ordinary laboratory apparatus. A single determination by this method takes up twenty minutes, it is applicable to 0.05 milliequivalent of nitrate, and a precision and accuracy of 99.8 per cent. are claimed.

The same method has been extended[13] to the estimation of nitric oxide in gases. The sample of gas is washed with dilute alkali to scrub it free from higher oxides of nitrogen, and the nitric oxide is then oxidised with alkaline permanganate, which absorbs the nitrogen dioxide formed. The absorbent solution is then placed in the apparatus already described, the permanganate is decomposed with oxalic acid, which also adjusts the *p*H of the solution, and reduction with Devarda's alloy and determination of the ammonia follow. As little as two parts of nitric oxide per million may be determined, and the precision of the method is 99.0 per cent.

Colorimetric Methods

An investigation of the colorimetric determination of ammonia with Nessler reagent[14] indicates that the solution being determined should be within the range 0.105-0.135 *N* with caustic alkali before treatment with the Nessler reagent, otherwise the reaction may not be quantitative.

An absorptiometric method for determination of small amounts of ammonia has been described by Russell[15]. The reagent solutions are (1) 0.003 M manganous salt solution, (2) 25 g. phenol mixed with water, and 54 ml. of 5 *N* caustic acid added, the whole being diluted to 100 ml., and (3) 25 g. of bleaching powder dissolved in 300 ml. of hot water, 135 ml. of 20 per cent. potassium carbonate solution added, and the whole diluted to 500 ml. To 1.5 ml. of the sample are added one drop of Solution 1, 1 ml. of Solution 2, and 0.5 ml. of Solution 3. The vessel containing the mixture is placed in a boiling-water bath for five minutes, and cooled. The absorption is measured with a 625 mμ filter. Alternatively, the colour may be compared with those of standards similarly prepared.

In order to determine nitrate, nitrite, and ammonia on a single sample of soil extract, Wolf recommends[16] three colorimetric determinations on aliquots of the extract. Total nitrate and nitrite are determined absorptiometrically, the reagent being brucine in 1 per cent. sulphuric acid. Nitrite is then determined by dimethylaniline in 1 : 6 hydrochloric acid, giving nitrate by difference. Ammonia is finally determined by Grave's reagent (sodium chloride, mercuric chloride, lithium carbonate, and talc). The accuracy for each determination is of the order of 0.1-0.2 parts per million for 0.1-2 parts per million of nitrate, and for 1-5 parts per million of the other constituents.

Oxides of Nitrogen

Gasometric determination of nitric oxide may be carried out by absorption of the gas with a solid reagent prepared by grinding together solid potassium hydroxide and sodium sulphite[17]. The resultant paste, formed into a bead on a platinum wire loop and dried somewhat, takes up the nitric oxide in a few minutes, as sodium hyponitrososulphate.

The estimation of small amounts of nitric oxide in coal-gas has also been described by Dudden[18], the procedure depending on transformation to nitrogen dioxide, using nascent oxygen from the anode of an electrolytic cell, and subsequent colorimetric or tintometric determination, using Griess reagent.

The determination of nitrogen dioxide in, for example, mixed acid or acid from the Ostwald process may be carried out volumetrically[19]. The acid is added to a known amount of standard ammonium hexanitratocerate in perchloric acid solution, and the excess cerate is titrated against sodium oxalate, using nitro-*o*-phenanthroline-ferrous complex (nitroferroin) as indicator. This

method is claimed to be more rapid than, and as accurate as a permanganate method: it is more accurate as a routine check under rushed laboratory conditions; while it suffers from none of the disadvantages of the permanganate method.

To conclude this review of methods for nitrogen in various forms, a polarographic method for nitrate, recently described[20], may be included. In a solution containing uranyl ions, the diffusion current of the nitrate at −1.2 volts (calomel), corrected by the diffusion current of a blank, is proportional to the nitrate content over the range 5×10^{-5} to 4×10^{-4} molar nitrate, and may be read off from a calibration curve. The determination has the added advantage that it is suitable for use in the presence of chlorate or sulphate.

Determination of Calcium

Qualitatively, calcium may be distinguished from barium (but not from strontium) by precipitating as the sulphate, treating with lead nitrate solution to convert to lead sulphate, and subsequent treatment of this with a 0.2 per cent. aqueous sodium rhodizonate solution at a *p*H of about 2.8 (tartaric-acid/sodium-bitartrate buffer)[21]. A red colour develops. The test may be carried out as a spot test.

While the determination of alkaline earth metals by direct titration with sodium carbonate (using phenolphthalein as indicator) is not very accurate if carried out as usually described, primarily because of the slowness of the reaction, it has been found[22] that the accuracy is much improved when the solution contains a considerable concentration of acetone. For calcium determination the most satisfactory procedure is to add rather less than the anticipated amount of sodium carbonate solution rapidly (about 95 per cent. of the presumed amount), boil, cool, and add acetone in the ratio of about one volume of acetone to 3.7 volumes of liquid being titrated. The titration is then completed normally, when an error of 0.1-0.2 per cent. is reported.

Calcium may be simply determined in the presence of strontium and barium by making use of the different solubilities of the sulphates in perchloric acid[23]. All the sulphates are soluble in boiling 60 per cent. perchloric acid. On dilution, however, barium sulphate is precipitated immediately and strontium sulphate comes down on vigorous stirring and allowing to stand. Calcium sulphate, on the other hand, is not reprecipitated, and calcium may be determined in the filtrate by rendering this slightly alkaline with ammonia, boiling, and precipitating the oxalate with ammonium oxalate solution. The separation of calcium from barium is straightforward. That from strontium is less easy, and excess sulphuric acid is added to help bring down the strontium sulphate.

Determination of calcium (among other elements) in foods involves destruction of the organic matter, and for this purpose oxidation in 50 per cent. ammonium nitrate in 25 per cent. nitric acid is stated to have a number of advantages over wet-oxidation with sulphuric acid or perchloric acid, or direct ashing[24]. The sample is heated gently with the oxidant until all water is expelled, this having the effect that the subsequent heating is really in a melt of ammonium nitrate. Finally, excess ammonium nitrate is driven off, the residue is dissolved in 2 ml. of hydrochloric acid, evaporated to dryness, and fused. A second treatment with hydrochloric acid is given, and the residue is then taken up in 10 ml. of water which is slightly acid with hydrochloric acid. The calcium is determined in 2 ml. of this solution, by buffering and precipitation of the oxalate, which is then titrated with 0.01 *N* permanganate solution.

A similar method for the determination of calcium in limestones and related products is found[25] to be satisfactory, since quite large amounts of iron, aluminium, and phosphate have little or no effect on the accuracy of the method. Smaller amounts of manganese and titanium give rise to inaccuracies, but the results are still accurate in the presence of amounts of these elements to be anticipated in the products in question. The calcium is precipitated with ammonia-ammonium oxalate, dissolved in 5 per cent. sulphuric acid, and then titrated in the normal fashion, above 60°C., with 0.1 *N* permanganate solution.

Modified Permanganate Method

Direct determination of the oxalate with permanganate has been modified somewhat in another investigation[26], this being rendered possible by the fact that permanganate solution containing manganous sulphate and sulphuric acid reacts quantitatively with both oxalic acid and with potassium iodide, at ordinary temperature. Therefore the oxalate is precipitated, and excess potassium permanganate solution added. This, in turn, is titrated iodometrically, the end-point being claimed to be much more exact than the ordinary permanganate end-point.

In a previous article in this series[27] reference was made to criticisms of the permanganate method for calcium, and to alternative methods. Other alternative methods have been proposed for the conclusion of the determination. Ammonium hexanitratocerate in perchloric acid has been used to titrate the oxalate at room temperature[28], using setopaline C as indicator. Directions for preparation of the reagent, to prevent hydrolysis of the cerate, are given. After standardisation the solution should be kept cool and stored in brown, or preferably, in black

painted bottles. In these conditions the standard solution is reasonably stable, only 2.5 per cent. deterioration being found over 90 days. The oxalate should be carefully precipitated under controlled conditions, the solution if necessary being made acid to hydrochloric acid, and then neutralised. After precipitation, it should be allowed to stand for an hour before filtration. The oxalate precipitate is then dissolved in perchloric acid which must not be stronger than N, as otherwise low calcium figures are obtained. This is presumably due to oxidation of the oxalate. It is found that if the precipitate is allowed to stand for an hour as described, digestion has no effect on the result, nor has the amount of ammonium chloride present any appreciable influence.

The determination of calcium on both micro and ultramicro scales by comparable methods has been described[29]. On the micro scale the sample (*e.g.*, serum) is precipitated with ammonium oxalate, the precipitated calcium oxalate is centrifuged, washed, and converted to the carbonate by heating. This is then dissolved in hot 10 per cent. boric acid. The solution is diluted, and titrated to the *p*H of pure boric solution. Using 200 μg. of calcium, an accuracy of -0.3 per cent. and a precision of ± 0.6 per cent. are obtained. On the ultramicro scale the determination is carried out on samples with a calcium content of the order of 7-11μg. The principle of the method is similar to that for the micro scale, but smaller quantities of reagent, and a special type of centrifuge tube with a flat bottom are employed. The titration is carried out as already described for the determination of nitrogen on this scale.

Instrumental Methods

Wood[30] recommends a spark spectrographic method for the determination of calcium in the presence of large amounts of magnesium. The sample is dissolved in dilute hydrochloric acid with a standard addition of a nickel solution. The spectrum is then photographed under high voltage alternating current, using graphite electrodes. The calcium line, 3159 A.U., is compared photometrically with the nickel line, 3102 A.U., and the ratio is transformed to calcium content by means of a calibration curve. Where the calcium content is of the order of 0.05-0.25 per cent. of the magnesium content, an accuracy of ± 2.5 per cent. of the amount of calcium present is claimed. As this content corresponds to the usual calcium content of commercial magnesia, the method is therefore suitable for use in the control of this product.

A spectrographic method for calcium present in magnesium in even smaller amounts —of the order of 0.0005 to 0.1 per cent.— has also been proposed[31]. A high-voltage spark method is used, one electrode being graphite, the other a rod of the metallic sample. No chemical method is suitable for this range of calcium content, and, since the calibration curves are determined by using solutions containing known amounts of calcium, the precise amounts of calcium in the controls are determined spectrographically by a special method of extrapolation. This is because it is not possible to obtain magnesium samples which are completely free from traces of calcium, and therefore the true calcium content is not identical with the amount of added calcium. The line-pairs calcium 3969 A.U.: magnesium 2779 A.U., for amounts of calcium greater than 0.1 per cent., and calcium 3933 A.U.: magnesium 2781 A.U. for lower amounts, are recommended as a basis for the estimations.

Finally, calcium oxide has been determined in magnesia by X-ray methods[32]. Where the calcium oxide content is very low (of the order of 0.1 to 1.0 per cent.) it is possible to find a relation between content and the relative strengths of certain of the X-ray reflection lines of the calcium oxide and the magnesium oxide, in powder photographs of the samples. The comparison has been made visually, and accuracy might be improved by some photometric method of measuring the density of the lines.

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Personal Notes

MR. T. LEVY has resigned from the board of British Celanese.

MR. N. CHINN has resigned from the board of British Emulsifiers, Ltd.

DR. C. H. KELLAWAY has been elected deputy chairman of the board of the Wellcombe Foundation.

DR. G. P. CONTRACTOR has been appointed assistant director (planning), at the Indian National Metallurgical Laboratory.

DR ATMARAN has been appointed Officer-in-charge of the Central Glass and Silicate Research Institute, Calcutta.

SIR HUBERT HOULDSWORTH, who accepted the post of Controller-General at the Ministry of Fuel and Power for the period of the war, has now been released.

The King has approved the appointment of SIR LIONEL E. H. WHITBY as Regius Professor of Physic at Cambridge University. Sir Lionel, who was knighted in the New Year Honours, discovered and perfected, with the chemists May and Baker, the drug M and B 693.

MR. T. E. NIXON, director of Light Metals Control (Sheet and Strip), at the Ministry of Aircraft Production since 1941 is returning to the Northern Aluminium Company Ltd., on September 1, as assistant manager of the London area sales office, which will be reopening in October.

SIR FRANK S. SPRIGGS, chairman of the Hawker Siddeley Aircraft Co., and SIR ROY H. DOBSON and MR. H. K. JONES, directors of the said company, have been appointed to the board of High Duty Alloys. MR. D. MCKELLAR, who was the former representative of Hawker Siddeley, retires in consequence.

Forthcoming Events

September 10. Institution of the Rubber Industry (London Section). Caxton Hall, Caxton Street, Westminster, S.W.1, 6.30 p.m. Mr. W. D. Rae: "The Chemistry of the Rubber-to-Brass Bond."

September 12. British Association of Chemists (London Section). Kingsway Hall, Kingsway, London, W.C.2. 6.30 p.m. Mr. H. T. F. Rhodes: "The Chemical Examination of Documents."

September 12. Institute of Metals. Annual autumn meeting. Institution of Mechanical Engineers, Storey's Gate, London, S.W.1. 10.0 a.m.-12.45 p.m.: Formal business, and Mr. L. de Brouckère: "An Electron-Diffraction Study of the Atmospheric Oxidation of Aluminium, Magnesium and Aluminium-Magnesium Alloys," Mr. H. A. Sloman: "The Application of the Vacuum-Fusion Method to the Determination of the Oxygen, Hydrogen and Nitrogen Contents of Non-Ferrous Metals, Alloys and Powders," and Mr. J. C. Chaston: "Some Effects of Oxygen in Silver and Silver Alloys." 2.15 p.m.-4.0 p.m. Mr. W. A. Baker: "Microporosity in Magnesium Alloy Castings," and Mr. F. A. Fox: "The Properties of Some Magnesium-Aluminium-Zinc Casting Alloys and the Incidence of Microporosity."

September 19. British Association of Chemists (London Section). Assembly Hall, Royal Empire Society, Northumberland Avenue, London, W.C.2 (entrance in Craven Street), 6.30 p.m. Open meeting: "Social Security for Chemists."

September 21. International Society of Leather Trades' Chemists. Lecture Theatre, New Chemistry Building, Leeds University, 2 p.m. Professor A. C. Chibnall: "The Contribution of the Analytical Chemist to the Problem of Protein Structure" (Second Procter Memorial Lecture).

September 27. Association for Scientific Photography. Alliance Hall, 12 Caxton Street, Westminster, London, S.W.1. 6.30 p.m. Mr. R. Peel: "Recording Engineering and other Work by Stereoscopic Photography."

A revised edition of List 815, which deals with the latest developments of the "Siemens" Automatic Regulators for heat control, has been published by ELLIOTT BROTHERS (LONDON), LTD. A recently introduced general purposes pattern, the "O" Regulator, for "On-Off" or "High-Low" control is included, and particulars are also given of the latest type of "F" Regulator for "Floating" control, with the necessary ancillary equipment for both types. These regulators have many general applications and may be used wherever it is possible for a measurement to be made by electrical methods.

They have a special application in connection with industrial manufacturing processes in the chemical industry using thermo-electric and total radiation pyrometers, electrical distance thermometers, humidity meters, and gas analysis equipment.

As the Bahamas may possess valuable petroleum deposits, the chief oil groups have sent representatives and formed local corporations. However, no exploratory wells have yet been sunk, but the visiting experts have expressed optimistic views.

At an experimental coal gasification plant near Tula (Russia), destroyed by the Germans but captured and reconstructed some three years ago, the technical problem of underground gasification without mining has been solved. It is planned to drill 100 new shafts within a year.

General News

The business of Blairs, Ltd., Govan, manufacturers of sugar machinery and chemical plant, has been acquired by Mirlees Watson, Ltd.

The Merchant Navy Comforts Service has received a donation of £3 from the employees of I.C.I. (General Chemicals), Ltd., Chance and Hunt Works, Oldbury, Birmingham.

A million tablets of M and B 693, valued at £1000, have been given to the British United Aid to China for the use of the Chinese hospital service by May & Baker, Ltd.

The Institution of Chemical Engineers announces that application forms and particulars of the Associate Membership Examination for 1946 (forms returnable on December 1) may be obtained from the Hon. Registrar, Institution of Chemical Engineers, 56 Victoria Street, London, S.W.1.

Research into the possible uses of seaweed and seaweed products is being carried out in the laboratories of University College, Galway, under the direction of Professor T. Dillon. Some time ago, the production of a satisfactory type of wallboard from seaweed was reported and regular shipments of seaweed from the west coast are being made to a factory at Oban, Scotland, for conversion into fibres for the production of artificial silk.

The fifth series of post-graduate lectures arranged by the London Section of the Oil and Colour Chemists' Association will be given by Professor E. N. da C. Andrade at the Royal Institution on October 11, 18 and 25, at 6 p.m., on the subject of "Viscosity and Plasticity." Admission will be by ticket, for which application should be made to Mr. D. E. Roe, honorary secretary, London Section, O.C.C.A., c/o Atlas Preservative Co., Ltd., Fraser Road, Erith, Kent. The fee for the three lectures is 10s., and the remittance must be sent with the application for tickets.

According to an announcement in *The Board of Trade Journal* of September 1, the following items should now be deleted from the list of commodities subject to M.E.S.C. procedure: tungsten, tungsten carbide, and manufactures substantially or wholly thereof: acetic anhydride, ammonium nitrate, butyl alcohol, carbon bisulphide, carbon black, carbon tetrachloride, chlorine, cresols and cresylic acid, diacetone alcohol, dicyandiamide, diphenylamine, ethyl alcohol, potassium perchlorate, phosphorus, phthalic anhydride, pyrethrum flour and pyrethrum extract, rotenone and derris, sodium chlorate, sodium nitrate, toluol and toluene, urea.

From Week to Week

The Institute of Metals has published the following reprints from its *Journal*: "The Supply of Accessory Metalliferous Minerals" (May Lecture for 1945), by Sir Thomas Holland; "Breadths of X-Ray Diffraction Lines and Mechanical Properties of Some Cold-Worked Metals," by Helen D. Megaw and Dr. A. R. Stokes; and "The Solubility of Certain Metals in Gold," by Professor E. A. Owen and Mr. E. A. O'Donnell Roberts.

Foreign News

Quebracho extract produced in Argentina during 1943 by 16 factories totalled 162,722 metric tons.

The Nobel Foundation in Stockholm has announced that two Nobel Prizes in chemistry will be awarded this year.

A grant for the manufacture of common salt in Barbados has been approved by the Colonial Office.

The U.S. National Lime Association announces that the industry has been completely reconverted to peace-time output.

Zinc oxide, which, since February, has been sold in Sweden only against Government allocation, is now on the free list again.

An examination of materials in the Chipongwe area of North Rhodesia is to decide whether cement can be made locally.

An appropriation of $400,000 for the construction of new units to expand the Wilmington research facilities of the Atlas Powder Co. has recently been approved.

Plant and equipment are being installed at the Indian Institute of Science at Bangalore to produce 100,000,000 units of penicillin monthly.

A Second List of Publications on DDT has been prepared by Mr. R. C. Roark, U.S. Bureau of Entomology and Plant Quarantine (mimeographed).

The wood pulp distillation plant at Chajlowka, in Poland, has resumed operations with 300 workers and treats 100-150 cubic metres of wood pulp per day. The products include ethyl alcohol, acetone, acetic acid, and charcoal.

The Canadian advisory committees on plastics and dyestuffs are to be disbanded owing to improved supplies. Control orders which have been removed include acetylene black, phenol, and vinyl polymers.

The Standard Chemical Company announces that it has acquired the capital stock of the Dalglish chemical companies, Dalglish (Ontario), Ltd., and Dalglish (Quebec), Ltd.

It is hoped that kyanite deposits in the Nellore district, Madras, will find a wider use in post-war industrial development, especially as a refractory in the ceramic industry.

The Stainless Steel Products (Pty.), Ltd., 70 Standard Bank Chambers, Johannesburg, has recently been registered with a capital of £50,000.

E. I. du Pont de Nemours & Co. has made application to the W.P.B. for a major expansion at the cellophane plant in Clinton, Iowa, to meet anticipated demands for transparent packaging.

A new Office of Research and Inventions has been established by the United States Navy under the direct supervision of Secretary Forrestal as the result of a merger of four research offices.

A new Polish-Swedish trade agreement provides for shipments of Swedish tanning extracts, wood pulp for rayon, and iron ore to Poland, while Polish salt, zinc, coke and coal are to be sent to Sweden.

In the Soviet Union, a penicillin plant has been set up at Kislovodsk under Professor Ermolyeva; its first output will be available in the next few days for hospitals in the Caucasus region.

The great expansion in alcohol production for war purposes on the North American Continent is shown by the fact that in 1941 distillers used 2,000,000 bushels of grain; in 1942 this had soared to 54,000,000 bushels, and in 1943 to 110,000,000.

Company News

The Triplex Safety Glass Co., Ltd., has made a net profit, for the year to June 30, of £106,394 (£143,522). The ordinary dividend is 15 per cent. (same).

The Low Temperature Carbonisation Co., Ltd., reports a net profit, for the year ended March 31, of £51,444 (£66,734). The dividend is being maintained at 4 per cent.

The United Indigo and Chemical Co., Ltd., reports a net profit, for the year to June 30, of £10,470 (£9831). The dividend has been increased to 7½ per cent. (6¼ per cent.).

The "Sanitas" Trust, Ltd., reports a revenue, for the year to May 31, of £63,623 (£64,438). The ordinary dividend is unchanged at 12½ per cent.

The Central Oil, Mining and Chemicals Trust, Ltd., reports a revenue, for two years to January 31, of £132, reducing the debit forward to £7667.

British Chemical Products & Colours, Ltd., 6 Broad Street Place, London, E.C.2, have changed their name to Danks Investments, Ltd.

The Dow Chemical Co. reports a total income for the year to May 31 of $127,987,537 ($124,656,781). Net earnings total $8,738,761 ($8,573,503). Earned per common share $6.02 ($6.34).

The directors of **Geevor Tin Mines** have called an extraordinary meeting for September 26, when it will be proposed that the 412,800 5s. shares be converted into £103,200 of stock, transferable in multiples of 5s.

Cooke, Tweedale & Lindsay, Ltd., 76/80 City Road, Manchester, 15, have increased their nominal capital beyond the registered capital of £5000, by the addition of £10,000 in 6 per cent. preference shares of £1 each.

Borax & Chemicals, Ltd., cease to operate from Marlyn's House, Guildford, on September 8, when they return to their head office at Kingsbourne House, 229 High Holborn, London, W.C.1. Telephone: Holborn 6518 (private branch exchange). Telegrams: Boraxchem Phone London. Cablegrams: Boraxchem London. The branches at Liverpool and Birmingham remain as at present.

Alliance Aluminium Holdings, Ltd., reports a net profit, for the year to June 30, of £6702 (£16,156). Its subsidiary, the **Aluminium Corporation, Ltd.,** states that it has made a profit, for 1944, of £10,648 (£44,703), while the **International Aluminium Co., Ltd.,** shows a decline in profits for last year to £12,681 (£33,941). The report is summarised on p. 214 of this issue.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an '— followed by the date of the Summary, but such total may have been reduced.)

UNIVERSAL PLASTICS, LTD., London, N. (M., 11/9/45.) August 7, mortgage, to Halifax Building Society securing £2250 and further advances; charged on land and factory at Wood Green, with fixtures, plant, etc., also 1 and 3 Lawton Road, Wood Green. *Nil. March 24, 1945.

Satisfaction

BAIRD & TATLOCK (LONDON), LTD., chemists. (M.S., 11/9/45.) Satisfaction August 20, of debentures registered May 24, 1932, to the extent of £1000.

Prices of British Chemical Products

MODERATELY active trading conditions have been reported from the London general chemicals market this week with a fair amount of fresh inquiry, although the volume of actual new bookings is not large. Values throughout the market are steady. Among the soda compounds, solid caustic soda is being taken up against contracts fairly steadily and a good demand is reported for caustic liquor. There is no change in the position of industrial refined nitrate of soda, which is in good request, while a fair demand is reported for the various grades of sulphide of soda, and a moderate business is passing in acetate of soda. Chlorate of soda and bichromate of soda are strong markets and are meeting with a steady demand, and there is a brisk inquiry for both grades of hyposulphite of soda. Among the potash chemicals the B.P. and technical grades of permanganate maintain a strong front, and there is a continued call for supplies. Bichromate is being steadily absorbed as offers are made, and acid phosphate of potash remains in good call. There is no improvement in the supply position of yellow prussiate of potash. In other directions the demand for white powdered arsenic and glycerine is maintained at recent levels and steady deliveries of formaldehyde are being taken up. Supplies of peroxide of hydrogen find a ready outlet, and alum lump is steady. Activity in the coal-tar products market has been fairly well spread over most sections, with pitch in steady demand for both home and export account. Cresylic and carbolic acid are fairly active, and creosote oil is a good market. Pyridine remains quiet, and a fair trade is passing in xylol and solvent and heavy naphthas.

MANCHESTER.—Prices generally on the Manchester chemical market during the past week have maintained a steady tone, but without much actual change. A moderate inquiry has been mainly on home trade account, though there has been a sprinkling of export buying interest, and a limited amount of new business has been reported. Contract deliveries of the soda compounds, the heavy acids, carbonate and bicarbonate of ammonia, alum, and oxide and carbonate of magnesia have been on a fair scale. The fertiliser trade has been a trifle busier in one or two sections, but the new season's demand has not yet developed to any appreciable extent.

GLASGOW.—In the Scottish heavy chemical trade there has been an improvement in the home business during the past week. Prices remain firm. There is no change in the position for export business.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton £39 10s.; 10 cwt./1 ton, £40 10s., 4/10 cwt., £41 10s.; 80% pure, 1 ton, £41 10s.; 10 cwt./1 ton, £42 10s.; 4/10 cwt., £43 10s.; commercial glacial, 1 ton, £49; 10 cwt./1 ton, £50; 4/10 cwt., £51; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r.

Aluminium Sulphate.—Ex works, £11 5s. per ton d/d.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Carbonate.—£37 10s. to £38 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Antimony Oxide.—£111 to £117 per ton.

Arsenic.—Per ton, according to quantity: 99/100%, £49 to £52; white, 98/99%, £47 to £50; grey, 96/97%, £42 to £45; grey, 95/96%, £40 to £43.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton, bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£15 to £16 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5½d. per lb.

Chromic Acid.—1s. 7d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Oxide.—Black, powdered, about £100 per ton.

Copper Sulphate.—£32 5s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., for 10 cwt., or more, £14 11s. 6d.; 5 to 10 cwt., £14 12s. 6d.; 2 to 5 cwt., £14 13s. 6d.; 1 to 2 cwt., £14 14s. 6d., d/d in sellers' returnable casks. Less than 1 cwt., 2s. 8d. to 2s. 10d. per lb. d/d. Maximum controlled prices.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £47 per ton for ton lots, carriage paid; smaller parcels quoted up to 50s. per cwt., ex store.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £52 per ton ex works; barrels returnable.

Lead Acetate.—White, 52s. to 55s. per cwt. according to quantity. MANCHESTER: £51 to £54 per ton.

Lead Nitrate.—About £47 per ton d/d in casks.

Lead, Red.—Basic prices, per ton: Genuine dry red lead, £45 10s.; rutile, £45 10s.; orange lead, £57 10s. Ground in oil: Red, £59; orange, £71. Ready-mixed lead paint: Red, £63 10s.; orange, £75 10s.

Lead, White.—Dry English, in 8-cwt. casks, £55 per ton. Ground in oil, English, in 5-cwt. casks, £67 per ton.

Litharge.—1 to 2 tons, £44 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 15s. to £22 15s. per ton.

Magnesium Chloride—Solid (ex wharf), £22 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercury Products.—Controlled price for 1-cwt. quantities: Bichloride powder, 15s. 8d.; bichloride lump, 16s. 3d.; mercury oxide, red cryst., 20s. 9d.; red levig., 20s. 3d.; red tech., 19s. 11d.; yellow levig., 20s. 2d.; yellow tech., 19s. 7d.; sulphide, red, 17s. 9d.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 2s. 4d. per gal.; pyridinised 64° O.P. 100 gals., 2s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£60 to £65 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

Paraffin Wax.—Nominal.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £73 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 7¾d. per lb.; ground, 8¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £67 5s. per ton ex store; hydrated, £61 10s. per ton.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 12s. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d station.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£21 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals, £21 10s. per ton for 2-ton lots; commercial, £15 per ton.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£20 to £23 10s. per ton.

Sodium Percarbonate.—21½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £26 10s. per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£4 10s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £18 5s. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton, ground, £15-£16.

Sulphuric Acid.—168° Tw., £6 10s. to £7 10s. per ton; 110° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £19 12s.; 5 to 10 cwt., £19 13s. 6d.; 2 to 5 cwt., £19 15s.; 1 to 2 cwt., £19 17s. Less than 1 cwt., 3s. 7d. to 3s. 9d. per lb. d/d, according to quantity. Maximum controlled prices.

Tin Oxide.—Nominal.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d: white seal, £38 15s.; green seal, £37 15s.; red seal, £36 5s.

Zinc Sulphate.—Tech., £20-£21 per ton, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 2d. to 2s. 1½d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£34 to £39 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s ped lb.

India-rubber Substitutes.—White, 6 3/16d to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £25 per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton d/d farmer's nearest station, £21 15s.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in September, £9 13s. rising by 1s. 6d. per ton per month to March, 1946.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. type "Special No. 1," new season's prices not yet fixed.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £15 15s. per ton; granulated, over 98%, £10 14s. per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6½d. to 7d. per gal., f.o.r. maker's works. MANCHESTER, 6½d. to 9⅜d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 4s. to £10 13s. per ton, according to m.p.; hot-pressed, £11 10s. to £12 14s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, 60s. to 65s. per ton, f.o.b. MANCHESTER: 65s. per ton f.o.r.

Pyridine.—90/140°, 17s. to 17s. 6d. per gal.; 90/160°, 13s. MANCHESTER, 14s. to 18s. per gal.

Toluol.—Pure, 3s. 0½d. per gal.; 90's, 2s. 4½d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. MANCHESTER: Grey, £24 to £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—September 5.—For the period ending September 29 (September 15 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £62. RAPESEED OIL, crude, £88. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised, £49; refined hardened deodorised, £53. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £49; refined hardened deodorised, £53. PALM OIL, refined deodorised, £53; refined hardened deodorised, £58. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, crude hardened, 42 deg., £51 10s.; refined hardened, 46/48 deg., £52 10s. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN, 30s. 6d. to 45s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Chemical and Allied Stocks and Shares

BUSINESS in stock markets was again moderate in most sections, with the tendency firm in the absence of selling. Sentiment was aided by anticipations of a favourable outcome to the Anglo-American negotiations following the end of Lend-Lease. Far Eastern bonds recorded substantial gains on the end of the war. British Funds eased after a further rise, main attention again being centred on 2½ per cent. Consols and Local Loans, although 3½ per cent. War Loan also moved higher earlier in the week. Buying of industrials was selective, directed mainly to shares of companies regarded as well placed to benefit from the revival of export trade, electrical equipment shares being particularly favoured in this connection, also Turner & Newall, Imperial Chemical, Borax Consolidated deferred, and Babcock & Wilcox. Textile shares strengthened.

Imperial Chemical firmed up to 38s. 6d. partly because the yield of over 4 per cent. attracted buyers, while there was a sharp rise to 50s. in Lever & Unilever, the higher dividend of the Niger Co. encouraging hopes that the results of the parent company, due shortly, may also announce an increased payment. In recent years Lever & Unilever has limited its payment to 5 per cent. However, earnings have been much in excess of this, the conservative policy arising from the dividend guarantee arrangement with Lever N.V., and the impossibility of ascertaining the position of the Dutch company during the war years. Dunlop Rubber became firmer at 51s. 6d., due partly to the decision to send plantation experts to Malaya. Borax Consolidated deferred made further headway at 45s., and British Oxygen were better at 85s., also British Aluminium at 43s. 3d. The units of the Distillers Co. showed steadiness at 114s. 9d., but British Plaster Board 5s. ordinary receded to 35s. 9d. Associated Cement reacted to 57s., but elsewhere, Murex held their recent improvement to 101s. 3d., and the shares of the Metal Box Co. changed hands at 88s. 9d.

The iron-coal section remained firm, colliery shares continuing to receive attention on the assumption that prices had recently been lowered unduly. Staveley showed firmness at 45s. 6d. xd. on satisfaction with the financial results, while Consett Iron strengthened to 8s. 6d. Thomas & Baldwins have been firm at 12s. 6d. xd. maintenance of the dividend being in accordance with expectations, while the higher profits created a good impression, particularly as they do not include income from overseas subsidiaries of Baldwins taken over under the merger. Baldwins Holdings 4s. shares were steady at 6s. Dorman Long have firmed up to 26s., Stewarts & Lloyds to 51s. 3d., and Tube Investments to £5¼, while United Steel were 24s. with the new preference shares 1s. 2d. premium. Babcock & Wilcox were good at 56s. 9d., Hadfields at 30s., Guest Keen at 29s. 9d. The electrical equipment section remained in favour, General Electric rising to 96s. 3d., English Electric to 55s. 9d., Johnson & Phillips to 76s., Siemens to 38s. 3d., and Crompton Parkinson to 32s. 9d.

Among textiles, Calico Printers firmed up to 20s. on the past year's higher profits. Bradford Dyers were better at 26s. 9d., and Bleachers at 14s. 3d. In other directions, Boots Drug were little changed at 54s. 6d., Sangers moved up to 30s. 9d., but Timothy Whites became easier at 42s. 3d. General Refractories were better at 16s. 3½d. Elsewhere, Triplex Glass receded to 40s. on the lower profits, but later showed a partial rally to 41s. The dividend is maintained at the higher rate of 15 per cent. to which it was raised a week ago. Small movements were shown among oil shares, but Anglo-Iranian rallied to 112s. 6d.

A major factory is to be established soon by the Government of Ceylon for the production of coconut shell charcoal for use in chemical processes. Australia is Ceylon's chief customer for this product, as up to 2000 tons are being used annually in her sugar industry.

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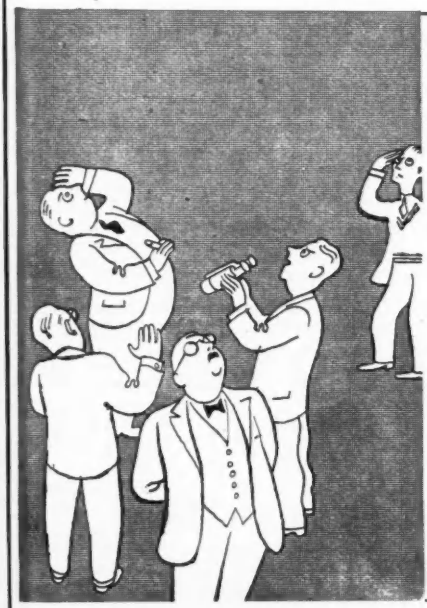

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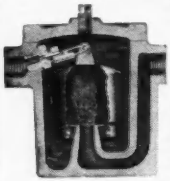

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Printed in Great Britain by THE PRESS AT COOMBELANDS, London and Addlestone, and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, E.C.4, September 8th, 1945. Entered as Second Class Matter at the New York, U.S.A., Post Office.